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The Motivational Effects of Knowledge of Results:
The Influence of Goal-setting *

Abstract

Research on knowledge of results (KR) has generally not controlled for motivational effects resulting from differential goal-setting. The present experiment was carried out to separate the effects of KR and goal-setting using a 2x2 fixed model design; the variables were KR versus No KR; and specific hard goals versus "do best" goals. The goals (manipulated by instructions) were representative of the goals typically assigned (explicitly or implicitly) to KR and no KR Ss in previous studies, respectively. No difference was found between KR and no KR groups, but a significant goal effect was found in favor of Ss given specific hard goals. The results indicated that effects previously attributed to differential KR were actually due to different levels of motivation produced by the different goals.

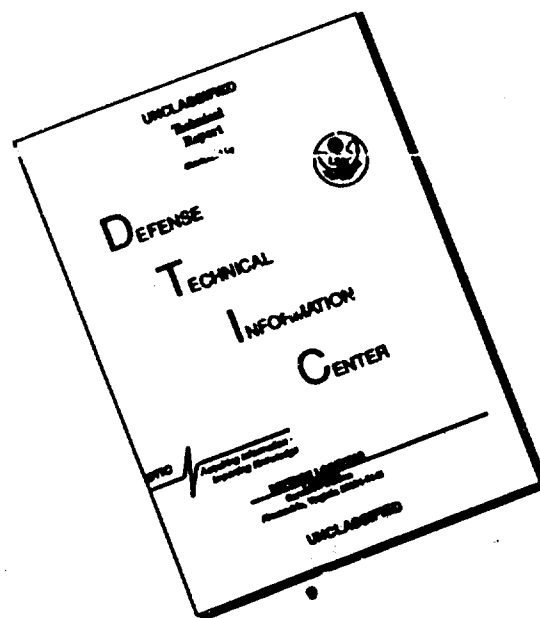
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The Motivational Effects of Knowledge of Results:
The Influence of Goal-setting¹

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The positive influence of knowledge of results (KR) on learning and performance is one of the best established findings in the research literature (Ammons, 1956; Bilodeau & Bilodeau, 1961, etc.) Research on KR has not been overly concerned with theoretical issues, but the fact that occasional studies fail to find significant KR effects on performance (e. g. , Chapanis, 1964) emphasizes the need to integrate and systematize findings in this area.

Several investigators (e. g. , Vroom, 1964) have distinguished between the information or cueing function of KR and the motivational function. The former refers to information given to Ss regarding the nature and locus of errors and the nature and type of the correct response (epistemic KR). Most studies of KR or "feedback" have been of this type (e. g. , Bilodeau & Bilodeau, 1961). Given a constant motivational state, the more information given to S about the task or about how to correct errors, the better his performance level or learning.

The manner in which knowledge functions to motivate S is much more complicated. One possibility for differentiating between epistemic and motivational KR is to give S knowledge that cannot be used for correcting errors or for changing the timing or locus of the response. Examples of KR that do not cue S as to a better method of performing would be: total time-on-target on a pursuit rotor task; total score after several trials on a computation task; total score after several throws on a dart throwing task.

Knowledge of score on simple motor tasks such as reaction time and weight lifting also falls into this category, since there are no right or wrong responses on such tasks. Any effects on performance of this type of KR may be attributed to motivational factors since presumably only S's level of effort is influenced.²

In the "classic" studies dealing with motivational KR such as those of Book and Norvell (1922), Crawley (1926), Mackworth (1950), and Ross (1927), Ss given knowledge of score were usually told to try to improve their performance or were given explicit goals to reach, whereas the No KR Ss were told not to think about trying to improve their scores or were told simply to "do their best." Although the KR groups performed better than the No KR groups in these experiments, the effects of goal-setting were confounded with the effects of knowledge of score, making it impossible to determine which was the critical variable or the interdependence, if any, between them. Similar criticisms can be made of recent studies, e. g., Church and Camp (1965); McCormack, Binding, and Chylinski (1962); McCormack, Binding, and McElheran (1963); and Payne and Hauty (1955). In these studies goals were not manipulated explicitly, but KR was given in relation to standards (such as S's best previous score) which clearly must have suggested goals to the Ss.

In five other studies (Arps, 1920; Johanson, 1922; Mace, 1935; Manzer, 1935; Gibbs & Brown, 1955) positive results were obtained for KR without explicit manipulation of Ss' goals; however, no attempt was made to determine if different goals were set by KR and No KR groups (although Mace argued that the effect of KR was to suggest a performance standard to the KR Ss). In contrast, Chapanis (1964), attempting to replicate the finding of Gibbs and Brown (1955), did two things to eliminate "demand characteristics" (Orne, 1962) that may have affected previous results: 1) he "hired" Ss as employees doing a job for pay (punching digits onto a tape) rather than as experimental Ss; and 2) he ran Ss individually rather than in groups (as was the case in most previous experiments in this area). In the absence of the implicit goal setting

demands (e. g. , "improvement") inherent in the typical experimental situation and the possible effects of implicit competition, Chapanis found no effect of KR on performance. Further, Locke and Bryan (1966b) found no overall effect of KR on performance on a complex computation task. But when Ss were re-grouped according to their a posteriori performance goal descriptions, a significant relationship of goals to performance was found, suggesting that differences in Ss' goals had more effect on performance than differences in KR.

The above findings suggest that the effects of KR should be separated from the effects of goal-setting in order to determine whether KR automatically influences performance level or whether its effects are mediated by goal-setting activity. The purpose of the present experiment was to test the hypothesis that effects previously attributed to differential KR were actually due to different performance goals associated with the different KR conditions. The major premise underlying this hypothesis is that level of effort on a task is determined largely by S's conscious performance goals. This emphasis on a cognitive approach to motivation is supported by recent theoretical developments (e. g. , Dulany, 1962; Miller, Galanter, & Pribram, 1960; Ryan, 1958, 1964; Spielberger, 1965) and by the findings of a number of recent studies (e. g. , DeNike, 1965; Dulany, 1962; Locke, 1966a, 1966b; Locke & Bryan, 1966a, 1966b; Spielberger, Berger, & Howard, 1963; Spielberger, Bernstein, & Ratliff, 1966; Spielberger, Levin, & Shepard, 1962).

Method

Task. The task was simple addition. Each problem consisted of three two-digit numbers and was presented on a separate 3x5 index card. The cards were placed consecutively in boxes holding 720 cards each. The Ss wrote their answers on sheets containing space for 90 answers. As each answer sheet was completed, S was instructed to insert it in a slot underneath a one-way mirror through which he was observed by E during the experiment.

The S worked for one hour at the task, which was divided into five trials separated by short rest periods. The trials were alternately 10 and 15 minutes in length (i. e. , 10'; 15'; 10'; 15'; and 10'). All Ss were told the length of each trial in advance.

Subjects. The Ss were 24 male and 12 female paid college (undergraduate) volunteers selected from a larger pool of 62 volunteers. All Ss in the original pool were given a pre-test consisting of three 1-minute trials on the addition task and asked to make three attitude ratings indicating their liking for and interest in "tasks like this." From this pool four matched groups of nine Ss each were selected as follows: four Ss were chosen who were approximately equal in ability and equal on the three attitude ratings; each of these Ss was then assigned at random to one of the four experimental conditions. This procedure was repeated until there were nine Ss in a cell. Thus the cells had almost identical means and distributions on the four matching variables. No attempt was made to match for sex; but as it turned out, the proportion of females to males was approximately equal for the main effects.

Design and Procedure

The experiment was introduced as a study of the development of attitudes toward the task. The structure of the task was explained. The Ss were told not to spend a lot of time checking answers since the total number correct was more important than the percent correct. While S worked, E stayed in the adjacent observation room. The S was made aware of the one-way mirror and was told E would remain there during each trial so as not to disturb S. Communication was possible through an intercom system.

The design was a 2x2 fixed model. The fixed variables were knowledge of score (KR) and type of goal.

KR Condition. The KR Ss were told the number of problems they had gotten correct at the end of each trial.

No KR Condition. The No KR Ss were not given their scores. Since Ss had to hand in each answer sheet after completion and since they did not know how many of their answers were wrong, these Ss could not easily keep track of their score except in a very general way.

Do Best Goal. "Do Best" Ss were told to "do their best" on each trial. (This was the goal typically given to No KR Ss in the experiments discussed earlier.) Do Best Ss in the KR condition could not easily use their scores to set specific personal goals due to the alternating trial lengths. In addition, Do Best-KR Ss were not allowed to perform any computations between trials that might enable them to determine their rate per minute (a pre-condition for setting a goal such as "improvement").

Hard Goal. Goals were set for the Hard Goal Ss on the basis of the scores attained by the matched "Do Best" Ss. On the first trial a given S's goal was set about 10 percent higher than the score achieved on the same trial by a matched Do Best S. Then E adjusted S's goal before each succeeding trial depending upon how well S had done on the previous trial. If S did not get near the goal, the next goal was lowered slightly; if S reached or exceeded the goal, the succeeding goal was raised.

The goals were marked by means of a colored 3x5 index card placed vertically at the appropriate point in the box of problem cards. This card represented the point they had to reach by the end of the trial in order to reach their goal (if they got all problems correct). The Ss were told to try and surpass this point since they were bound to get some wrong. They were told at the end of each trial whether or not they had beaten the goal but were not given their actual scores unless they were in the KR condition.

On the average the goals of the Hard Goal Ss were set from 0% to 32% (mean and median = 11%) above the scores attained by the matched Do Best Ss. Hard Goal Ss were ^{actually} able to reach or beat their goals on 16% of the trials.

The Ss had approximately two minutes' rest between trials during which E corrected their answer sheets (if they were in the KR condition) and

determined their new goals (if in the Hard Goal condition). To set the new goal, E came in the experimental room and placed the colored card at the appropriate place in the card box. No Ss were told how many problems were needed to reach the goal, and they could get^{only} a rough idea of this by seeing where the colored card was placed in the card box.

At the end of the experiment Ss were asked to look at a set of cards, each of which described a possible goal they could have had (e.g., "I tried to do my best"; "I tried for the assigned goal") and were asked to pick out the card that best represented their performance goal during the experiment.

Results

Three different performance measures were used: (a) deterioration scores defined as the difference between the mean number of problems correct per minute on the three pre-test trials and the mean number of problems correct per minute during the five experimental trials; (b) linear slope scores calculated from the number of problems correct per minute on the five experimental trials only; and (c) percent error on the five experimental trials.

The performance curves for each experimental sub-group, in terms of total problems correct per minute, are shown graphically in Figure 1.⁵ It is evident that both Hard Goal groups did progressively better than the Do Best groups, the difference between them reaching a peak in the last (10') trial period. On the other hand, the KR and No KR curves did not diverge except for the Hard Goal group in the last 10-minute period.

Insert Figure 1 about here.

The results of analyses of variance (using a standard 2x2 fixed model design) for the three performance measures are shown in Table 1. The goal effect was significant using both deterioration scores, $F(1, 32) = 4.83$, $p < .05$, and linear slope scores, $F(1, 32) = 12.87$, $p < .01$, with the Hard Goal group being superior to the Do Best group in both cases. A matched

groups test comparing the Hard Goal and Do Best groups (performed by matching each Hard Goal S with a Do Best S of equal initial ability) yielded a t-ratio for mean deterioration of 2.80 (17, $p < .02$), and a similar test using slope scores yielded a t of 3.18 (17, $p < .01$). There was no overall effect of KR on any of the performance measures, nor was there evidence of any interaction between KR and type of goal.

Insert Table 1 about here.

There were no significant main effects nor any interaction for the percent error criterion, indicating that the higher performance level attained by the Hard Goal group was not achieved at the expense of a relatively greater number of errors in relation to problems attempted. Both the Hard Goal and Do Best groups averaged about 5.6% errors during the experimental trials.

The results of the post-experimental questioning indicated that all Hard Goal Ss were either trying explicitly for the goals or had them in mind as they worked along. Eleven of the Do Best Ss said they were trying to "do their best"; four said they were trying to go at a "reasonably fast pace"; two tried to go at a "normal" or "slow" pace; and one S reported that he tried to complete one box of (720) problem cards by the end of the hour. The latter S was the only S in the Do Best condition who worked at a faster pace (in terms of problems correct per minute) during the experimental than during the three pre-test trials.

Discussion

The results of the present experiment support the hypothesis that motivational effects previously attributed to differential knowledge of results were actually a function of differential performance goals associated with the KR conditions. When differential goal setting by KR and No KR Ss was controlled, no overall effect of KR on performance was found. However, when the effects of the goals typically set by KR and No KR Ss in previous experiments (e. g. ,

specific Hard Goals versus Do Best) were compared, a significant goal effect was found. These results were consistent with previous findings by Locke and Bryan (1966b) where goals were measured by post-experimental interviews rather than manipulated by instructions.

Although the findings of the present study provide support for the initial hypothesis, there are a number of issues still open. It may be observed from Figure 1 that there was an effect of KR condition between trials 4 and 5. The KR groups increased their performance rate on trial 5, whereas the No KR groups decreased. The F for the difference scores (1, 32) was 8.83 ($p < .01$). It would be useful to determine whether this effect was due to implicit goal-setting on the part of the KR S s, who by this time may have been able to get some idea of their rate, or to some other effect.

Only two goal classes were used in the present study. In one sense the Hard Goals in the present experiment were harder than the Do Best goals, since the Hard Goals were set above the performance level of the Do Best S s. However, just "how much" harder is not known. A greater variety of performance goals should be utilized in subsequent studies and some attempts made to scale the goals as to difficulty or motivational level.

In more general terms, the results of the present study suggest one mechanism by which incentives of all types might work (e. g. , KR, money, instructions, participation, praise, reproof, verbal "reinforcement," etc.); it is possible that such incentives are effective only to the degree that they affect S 's goals or intentions. Research in the area of verbal learning (DeNike, 1965; Dulany, 1962; Spielberger et al, 1962) suggests that a verbal reinforcement (given that the response-reinforcement contingency is known) is effective in changing behavior to the precise extent that S desires or intends to get the reinforcement. In view of the seemingly inconsistent and often unpredictable effects of incentives on performance, it seems probable that the use of goals and intentions as mediating variables will be necessary if fully adequate explanations of the effects of incentives are to be achieved.

The present results suggest that in order to predict the effect of knowledge of score on performance level, it is not enough to know that the individual has such knowledge. It is also necessary to know what he does with it, i. e. how he evaluates it and what goals he sets in response to it.

Footnotes

1. This research was supported by contract Nonr 4792(00) between the Office of Naval Research and the American Institutes for Research. The author would like to thank Miss Judith Bryan of A. I. R. for analyzing the data for this study and Dr. Charles D. Spielberger of the National Institutes of Mental Health for his many helpful comments on this paper.
2. While it is true that scores of this type could be taken as a cue or signal to change one's method of performing the task or to change one's strategy, such scores do not yield information about what one did wrong or where the mistake(s) occurred. Nor does such knowledge tell one what kinds of corrections to make.
3. It is evident that in general the Ss showed deterioration (rather than improvement) in their rate of performance from the pre-test to the experimental trials. This can be attributed to two factors. First, little or no learning occurs over a short period of time with mature Ss on a task like addition. Secondly, the slightest lapse in concentration will slow one's addition rate. Since over a longer time span some attention lapses are inevitable, this produces a slower rate on the longer trials. The experimental trials in this case were 10 to 15 times as long as the (three one-minute) practice trials.

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Table 1

Analysis of Variance Results for Three Performance Criteria

<u>Deterioration</u>		
<u>Source</u>	<u>df</u>	<u>F</u>
Goals	1	4.83*
KR	1	< 1
GoalsxKR	1	< 1
Within (mean square)	32	(8,695.28)
<u>Linear Slope (Trials 1-5)</u>		
Goals	1	12.87**
KR	1	1.36
GoalsxKR	1	< 1
Within (mean square)	32	(797.78)
<u>Percent Error (No. Wrong/No. Attempted)</u>		
Goals	1	< 1
KR	1	1.32
GoalsxKR	1	< 1
Within (mean square)	32	(9.29)

* $p < .05$
** $p < .01$

FIGURE 1

TOTAL PROBLEMS CORRECT BY TRIAL PERIOD FOR EXPERIMENTAL

SUB-GROUPS

